NOKIA M2M PLATFORM APPLICATION DEVELOPMENT KIT
PRODUCT GUIDE

NOKIA

Contents

ACRONYMS AND TERMS

ADK	Application Development Kit
ANSI	American National Standards Institute
API	Application Programming Interface
CORBA	Common Object Request Broker Architecture
CSD	Circuit Switched Data
GIOP	General Inter-ORB Protocol
GPRS	General Packet Radio Service
GW	Gateway
HSCSD	High Speed Circuit Switched Data
HW	Hardware
IDL	Interface Definition Language
IP	Internet Protocol
M2M	Machine-to-Machine
OMG	Object Management Group
ORB	Object Request Broker
OS	Operating System
PCB	Printed Circuit Board
RADIUS	Remote Authentication Dial-In User Server/Service
SMS	Short Message Service
SMSC	Short Message Service Centre
SW	Software
TCP	Transmission Control Protocol
UDP	User Datagram Protocol (Internet)
WAP	Wireless Application Protocol
WIOP	Wireless Inter-Object Protocol

REFERENCES

Guide for Evaluation Module SW

Installation Guide for Nokia M2M Application Development Kit

1. ABOUT THIS DOCUMENT

This document describes the main characteristics of the Nokia Machine-to-Machine (M2M) Application Development Kit (ADK). The product concept, purpose of use, main features, and sales packages are depicted at a general level. More detailed information can be found at the Forum Nokia website, http://www.forum.nokia.com, from the Nokia M2M section. All Nokia M2M ADK documentation and installation software is downloadable from that website.

2.   INTRODUCTION

As we are quickly moving towards the world of third generation mobile traffic, more attention than ever is being paid to the wireless data market. So far, we have seen only the first steps towards the mobile information society, but it has already become clear that wireless data means more than just web browsing.

M2M communication is just one of the aspects of wireless data services. The market potential is huge; new applications are emerging continuously and operators are searching for opportunities for growth. The telecom industry is shifting in the direction of end-to-end solutions, which requires reliable communication and information transfer.

The Nokia M2M Platform is a complete, wireless, end-to-end solution for M2M communication. Nokia M2M ADK offers development tools for application development on the Nokia M2M Platform.

2.1   NOKIA M2M PLATFORM

The Nokia M2M Platform is an object-oriented software platform based on the Common Object Request Broker Architecture (CORBA)[1], which is an open and widely accepted industry standard. The Nokia M2M Platform is adaptable to a wide range of purposes and communication methods, and it meets the needs of many different applications. The Nokia M2M Platform hides mobile network complexities and, thanks to CORBA method calls, is transparent to different machines, operating systems, and language implementations.

The Nokia M2M Platform consists of the Nokia M2M Gateway and Nokia GSM Connectivity Terminals as shown in Figure 1.

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[1] CORBA is a widely distributed computing infrastructure, standardised by the Object Management Group (OMG) consortium. In short, CORBA applications are composed of objects that can locate in different machines. These objects have services, and they are utilised with request messages. CORBA hides the underlying transfer network, such as the Internet or GSM network, an also the underlying protocols so that a user can use the functions as local procedure calls.
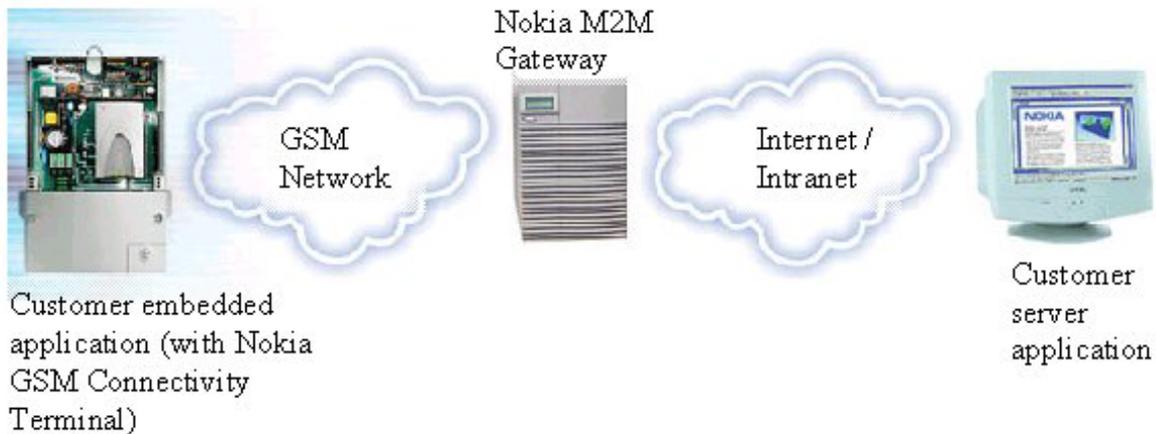
Figure 1. Nokia M2M Platform

2.2 OTHER NOKIA M2M PLATFORM PRODUCTS

2.2.1 Nokia M2M Gateway

The Nokia M2M Gateway provides wireless CORBA access and interoperability to the Internet. The Nokia M2M Gateway bridges the GSM network and Internet by wireless connection establishment and protocol translation between applications located on the Internet and in remote devices. The CORBA middleware is optimised for the wireless bearer, and the Nokia M2M Gateway translates the protocol into a standard CORBA Internet Inter-ORB Protocol (IIOP).

The following three editions of the Nokia M2M Gateway are available:

Nokia M2M Gateway Corporate Edition is targeted for companies choosing to own and manage the gateway along with the server application. This gives the company independence and control over the service quality. Access to SMS-C, USSD-C and GGSN can be rented from the network operator.

Nokia M2M Gateway Service Provider Edition is targeted for telecom operators and other Nokia M2M Gateway service providers (GSP). The distributed architecture enables the hosting and maintaining of applications for many customer companies. Separate Gateway Access Software is provided for client companies and the service-provider. Access control from terminals to the company intranet is handled by the Gateway Access Software so that the companies can freely manage the access rights.

Nokia M2M Gateway Trial Version is intended for trial purposes and for testing the applications in the development phase. The Nokia M2M Trial Version supports SMS and data calls over the GSM network through the Nokia GSM Connectivity Terminal attached to the host computer. This Trial Version

has a limited set of features compared to Corporate and Service Provider editions.**Nokia 30 GSM Connectivity Terminal**

The Nokia 30 GSM Connectivity Terminal, presented in Figure 2, is an M2M communications device with versatile interfaces and advanced functions. It forms part of Nokia M2M Platform solution, comprising terminals and the Nokia M2M Gateway.

Nokia 30 has many useful features:

- Dual band EGSM 900/1800 MHz

- GPRS multi-slot class 6 (max 3 + 1, 2 + 2)

- HSCSD multi-slot class 6 (up to 43.2 kbps)

- CSD (up to 14.4 kbps)

- Messaging services (SMS, USSD)

- 3 operational modes (M2M System Mode, AT Command Mode, User Control Mode)

- Wireless bearer selection

- Remote I/O control

- Reliability & security features (e.g., AutoPIN)

Figure 2. Nokia 30 GSM Connectivity Terminal

3. NOKIA M2M ADK PRODUCT CONCEPT AND USAGE

The Nokia M2M Application Development Kit (ADK) belongs to the Nokia M2M Platform product family. The Nokia M2M ADK provides a set of tools for creating applications on the Nokia M2M Platform and testing them in the development phase.

The Nokia M2M ADK is the easiest way to become familiar with Nokia M2M Platform technology. It shows how to utilize the built-in features of the Nokia M2M Platform concept with simple example applications. Extensive documentation supports these example applications and gives instructions for the development work.

The Nokia M2M ADK consists of HW, SW (open source), Tracer tool, documentation, Nokia M2M Gateway Trial Version and Nokia GSM Connectivity Terminals. The Gateway and terminals are not described in detail in this document as they have their own specific product guides.

To get all the advantages and achieve the full functionality of the ADK, the developer needs

- 2 Nokia GSM Connectivity Terminals (Nokia 30)
- Evaluation module (see description in Chapter 4)
- 2 Power supplies (ACW-5) with AC cable
- RS-232 serial cable
- ADK SW that includes Configurator SW for the terminals and Nokia M2M Gateway Trial Version

The Nokia M2M ADK set up is shown in Figure 3.
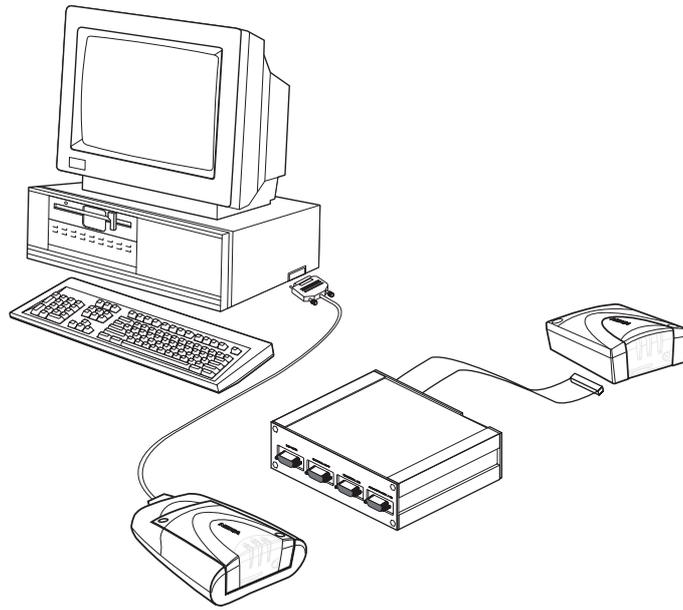
Figure 3. Nokia M2M ADK set-up

4. EVALUATION MODULE

The Nokia M2M ADK includes an evaluation module, which is an example HW for the embedded application module. One of the example applications in the Nokia M2M ADK can be used to control evaluation module digital and analog inputs and outputs, see Chapter 7. In addition to these inputs and outputs, the evaluation module has interfaces for standard RS-232, SW downloading and tracing.

Figure 4. Evaluation module for Nokia M2M ADK

4.1 INTERFACES

4.1.1 M2M system interface

The preferable interface between the Nokia GSM Connectivity Terminal and the application module is the M2M system connector. A 50 pin female M2M system connector in the evaluation module supports CORBA messaging, power input and an output digital audio interface (external audio codec is required).

The M2M system connector offers an open interface for application developers and effective and reliable methods for controlling the terminal and the application.

4.1.2 Power interface

The evaluation module has a power interface for the ACW-5 Nokia Power Supply. The input voltage range is 6.4 V - 13.5 V, and the absolute maximum rating is 16.5 V.

This power interface is not needed if power is supplied from the terminal through the M2M system connector. Alternatively, the evaluation module can supply the terminal through this same interface.

4.1.3 Service interface

The service interface in the evaluation module is a D9 female connector with an output voltage range of 0 − 3.3 V. This interface supports tracing the SW running in the evaluation module and downloading a remote-end application SW into the evaluation module. Controlling the evaluation module with a PC is also possible through this interface.

4.1.4 RS-232

The evaluation module has a D9 connector for the standard RS-232 interface. Through this interface, the developer can control the Nokia GSM Connectivity Terminal connected to the M2M system interface with AT commands. Through this interface the evaluation module can be used as a CORBA over an RS-232 adapter when testing the Nokia 30 terminal.

4.1.5 Digital output interface

One D9 connector in the evaluation module is reserved for digital outputs. There are 8 conventional digital outputs with HIGH and LOW states in a voltage range of 0 V − 3.3 V. LEDs on the evaluation module circuit board indicate the ON/OFF status of the digital outputs.

4.1.6 Digital input interface

One D9 connector in the evaluation module is reserved for digital inputs. There are 8 conventional digital inputs with HIGH and LOW states in a voltage range of 0V - 5V. These inputs also have a tolerance of 5 volts, for example for interfacing with 5V logic.

4.1.7 A/D and D/A converter interface

One D9 female connector in the evaluation module is reserved for A/D and D/A converters. There are two analog inputs with an input voltage range of 0 − 5 V and two analog outputs with an output voltage range of 0 − 3.3 V. Both directions are with high impedance but are not buffered.

4.1.8 Tracing interface

The evaluation module has an interface for tracing the traffic in the M2M system interface between the evaluation module and the Nokia GSM Connectivity Terminal. Physically there are two D9 connectors on the PCB, one for tracing the traffic from the evaluation module and one for tracing the traffic to the evaluation module. Tracing requires compatible PC software that is supplied with the Nokia M2M ADK.

4.2 SW FEATURES

The evaluation module SW is ported on the µC/OS-II operating system. An OS-kernel is provided as a read-compiled library, so it can not be reconfigured without recompiling. To re-configure the kernel, the developer needs the µC/OS-II licence (Micrium). All other SW for the evaluation module is written in portable ANSI-C and provided with the source codes. The following SW components are included:

- Example applications

- ORB software module

- M2M system protocol software module

- OS and hardware wrappers

Example applications are described in Chapter 7 and the rest of the components are described below.

A detailed description of the evaluation module SW can be found from the Guide for Evaluation Module SW, which is included in the Nokia M2M ADK documentation.

4.2.1 ORB SW module

An optimised ORB for an embedded environment is provided as a software module. The size is about 60kbytes. Example implementation for integrating this source code to a functional environment is provided.

Developers are free to use an ORB of they own, such as any commercial ones. The integration procedure of ORB is described; as are connections to other modules and available services.

4.2.2 System protocol SW module

The terminal to application module serial port datalink protocol is provided as a software module. The size is about 60 kilobytes. Example implementation for integrating this source code to a functional environment is provided.

4.2.3 OS & HW wrappers

This SW module integrates other M2M components to other embedded SW. The purpose is that M2M components could remain the same as far as possible, whatever the overall system. This is achieved by defining a general purpose interface that can be easily mapped to various platforms. The size is about 1 kbyte.

4.3 MECHANICS

The Evaluation module is provided with aluminium mechanics. Dimensions are 152 x 144 x 45 mm. The mechanics is removable. A ribbon cable for the M2M system interface is also included.

	Warning: The ribbon cable for the M2M system connector is not designed for frequent connection and disconnection.

5. NOKIA M2M GATEWAY TRIAL VERSION

The Nokia M2M Gateway Trial Version is intended for trialling the Nokia M2M Platform technology and for testing purposes in the software development phase. The server application may be run on the same host as the Nokia M2M Gateway Trial Version.

Due to the limited connectivity services offered, the Trial Version has restricted suitability for commercial applications.

5.1 FEATURES

5.1.1 Bearers

The Nokia M2M Gateway Trial Version supports GSM short message service (SMS) and data calls (CSD) through a GSM terminal attached to the gateway host machine.

5.1.2 Traffic Optimisation

The Nokia M2M Gateway Trial Version optimises traffic on the wireless path by carrying out the CORBA naming service lookup for the actual object reference called. The address is the developer's chosen text string with which the object has been registered to the naming service.

This feature optimises the air interface usage for SMS connections and speeds up the operation of the Nokia M2M Application Development Kit (Nokia M2M Platform)

5.1.3 Messaging Reliability

The Nokia M2M Gateway Trial Version uses the reliable Transmission Control Protocol (TCP) for Internet connectivity. Wireless communications utilise message acknowledgement and retransmission for all bearers to ensure message delivery. In cases where the message cannot be delivered to the recipient, the originator is informed of the communications failure.

5.2 SYSTEM REQUIREMENTS

The Nokia M2M Gateway Trial Version is a software product running on Windows® NT 4.0, Windows 2000 and Windows 98. In addition, Java™ 2 Platform Standard Edition 1.3 and Java™ HotSpot 1.0.1 are required.

Table 1. Nokia M2M Gateway Trial Version system requirements

Product	Operating System	Hardware	Memory (RAM)	Hard disk space
Nokia M2M Gateway Trial Version	Windows NT 4.0 / Windows 98 / Windows 2000	Pentium III processor, minimum 500 MHz	Min 256 MB, 512 MB recommended	Min 200 MB

These requirements are the general requirements for the Nokia M2M ADK software.

6. CONFIGURATOR SW

The Configurator software is an accessory product for Nokia GSM Connectivity Terminals. It is used to modify the basic settings of the terminal so that the connection to the GW can be established. The following settings can be configured:

- GSM security settings
- GSM network settings
- GSM WAP parameter settings

A PC or laptop and an RS-232 serial cable are needed when configuring the terminal.

One of the Nokia GSM Connectivity Terminals used with the Nokia M2M ADK is used as a data modem in the server side and the other one is used in the M2M system mode at the terminal end connected to the evaluation module. Instructions on how to configure these terminals can be found in the Installation Guide for Nokia M2M Application Development Kit that is included in the Nokia M2M ADK documents.

7. APPLICATION EXAMPLES

The Nokia M2M Application Development Kit includes application examples that show how the Nokia M2M Platform application can be implemented. All application examples are available in source codes that make application development easier, as the codes can be copied, modified and used in the customer's own applications.

7.1 EVALUATION MODULE CONTROL APPLICATION

The evaluation module control application is an end-to-end application, i.e. the evaluation module is controlled from the server end through the Nokia M2M Gateway Trial Version, GSM network and Nokia GSM Connectivity Terminal.

The server application can query the current state of any individual input or any combination of up to 8 inputs from the database at any time. In addition, the server application can register its ORB to get an indication immediately, if any state transition is detected in the input lines.

LEDs in the circuit board show the status of the digital outputs. When a digital pin is set up, an LED is lit correspondingly. To verify analog outputs, an external device is needed (e.g.,a potentiometer).

This application includes a very simple user interface in the server application with radio buttons and scroll bars.

The evaluation module control application is implemented in Java (server application) and C (embedded application).

7.2 TERMINAL END APPLICATIONS

These applications control the Nokia 30 and use CORBA messaging via an RS-232 interface. To run the applications a terminal must be connected to the evaluation module with the system connector (flat cable). The evaluation module must be connected from the RS 232 port to a PC's communication port with a serial cable. The Nokia M2M Gateway Trial version is not needed with these applications. The purpose of these applications is to show developers how terminal IDLs can be used to control the terminal.

There are two applications: SetLed and SendSMS.

SetLed is used to control the terminal LEDs that are provided for application usage.

SendSMS is used to send and receive SMS messages in the Nokia GSM Connectivity Terminal connected to the PC by a serial cable.

These terminal end applications are implemented with C.

7.3   SERVER END EXAMPLE1 AND EXAMPLE2 APPLICATIONS

Nokia M2M ADK includes example applications for controlling the terminal connected to the evaluation module at the embedded end from the server side. In example application 1, the server end queries the remote terminal for a list of names of objects that are registered to the Object Request Broker (ORB) of the terminal (i.e. objects that can be found from the remote terminal). Example application 2 causes an LED to blink in the remote terminal. Both applications show how terminal IDLs can be used remotely.

These application examples are implemented with Java.

7.4   REMOTE I/O CONTROL APPLICATION

This application example shows how the remote I/O control feature of the Nokia 30 GSM Connectivity terminal can be used. The Nokia 30/31 offers remote input/output control for the M2M System Connector. Three pins of the M2M System Connector can be configured as digital or analog input, and five pins as digital output. Digital input states or analog voltages are sent over the network to the server where they are interpreted.

This example application includes a graphical user interface with scroll bars and radio buttons for easy controlling and monitoring. The states of the I/O pins (analog/digital) can be changed.

This application is implemented with Java.

8. M2M TRACER

The Nokia M2M Application Development Kit includes a tracer for logging the traffic over the M2M system interface between the evaluation module and the Nokia GSM Connectivity Terminal.

The tracer includes a tracer interface in the evaluation module and PC software. The PC is connected to the evaluation module tracing interface by a serial cable, see tracing interface Chapter 4.1.8. The user can set the hooks as he/she wants. Logs are saved in text files.

Traces can also be taken directly from the evaluation module by connecting the PC to the evaluation module's service interface with a serial cable, see evaluation module service interface Chapter 4.1.3.

9. IDL COMPILER

The Nokia M2M ADK includes an IDL compiler for the embedded application development. The IDL compiler is a program that reads IDL files and produces the necessary programming language-specific files: skeletons and stubs. These translate message data into a form that is appropriate for cross-platform messaging. This is described in Figure 5. The block arrows show that a client code-calling a method on the server only sees a local method call, which is no different from the mundane method-calls in non-distributed programming. The ORB, together with the generated stub and skeleton code, hides the distribution completely.
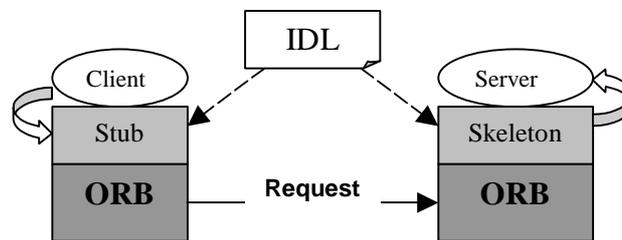

**Figure 5. Stub and skeleton files**

10. DOCUMENTATION

Nokia M2M ADK includes a lot of documentation concerning the ADK HW and SW and about application development on the Nokia M2M Platform. All the documents are available separately from the Forum Nokia website in Nokia M2M section, but they are also included in the CD-ROM in the evaluation module sales package.

11. SALES PACKAGE

To get full benefit of the Nokia M2M ADK, the developer needs two Nokia GSM Connectivity Terminals, an evaluation module and M2M ADK software in the installation CD-ROM.

Evaluation module sales package contains following items:

- Package carton
- Evaluation module
- Power supply with AC cable
- RS-232 data cable X 2
- Nokia M2M ADK Installation CD-ROM
- Product note
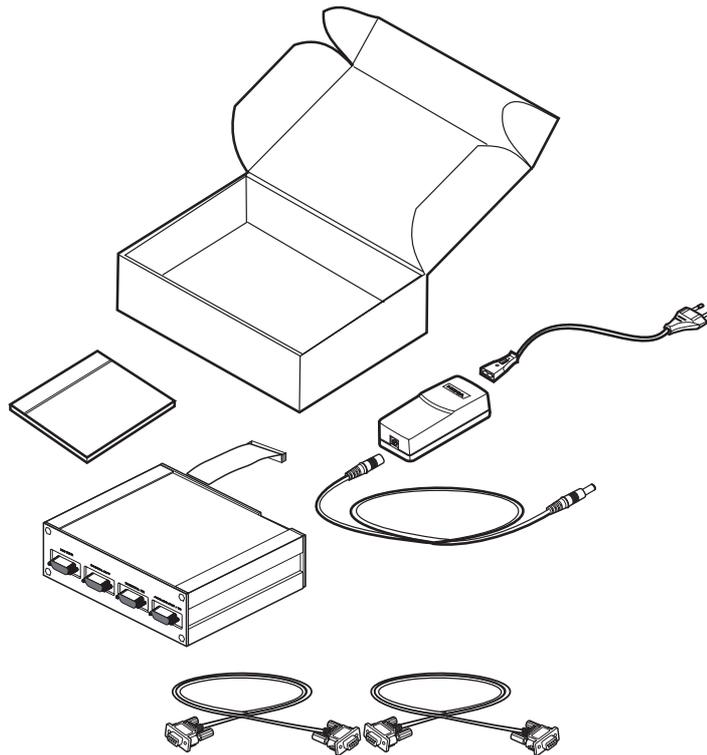
Figure 6. Evaluation module sales package

All Nokia M2M ADK documents and installation SW (includes all SW components of the Nokia M2M ADK) can also be downloaded free of charge from the Forum Nokia website, http://www.forum.nokia.com, under Nokia M2M.